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Through Research to Better Farming

WEST VIRGINIA AGRICULTURAL EXPERIMENT STATION

Through Research To Better Farming

CONTENTS

	Page
Crops, Pastures, and Soils	1
Orchards and Gardens	12
Poultry	22
The Director Speaks	25
Beef Cattle and Sheep	28
Dairy Stock and Dairying	32
Forestry	39
Special Topics	42
Changes in Staff	45
Publications of the Biennium 1944-1946	45
Research Projects of the Biennium	47

The Biennial Report of C. R. Orton, Director of the West Virginia Agricultural Experiment Station, Morgantown, for the Period 1944 - 1946

Compiled by Gerald Jenny, Editor

Bulletin 330 June, 1947

Agricultural Experiment Station
College of Agriculture, Forestry, and Home Economics
West Virginia University
C. R. Orton, Director Morgantown

CROPS, PASTURES, AND SOILS

Among Grain Varieties, What's Yours?

There are many matters that influence crop production over which the farmer has little or no control. But one thing he does have absolute control over is the seed that he sows.

Our variety tests at Morgantown and at various substations are carried on for your benefit, so that you can profit by comparisons. You need not go to the trouble of making numerous trials on your own farm.

Our winter barley tests have covered the state as a whole for a period of 3 to 5 years. Brier, Scottish Pearl, and Kentucky No. 1 have yielded consistently high. Union, Smooth Awn 86, and Kentucky No. 2 didn't fare so well, as you can see from the table.

Collins Veatch made several crosses in the greenhouse with the idea of developing more disease-resistant lines, with better stand ability, than those we are now recommending.

In regard to winter wheat varieties, Thorne, Fairfield, and Fulhio have proved to be high yielding in general. Here, again, we find considerable variation in different parts of the state, as the next table shows.

Some of the varieties of spring oats that we have formerly recommended, like Keystone, Lenroc, Gopher, and Columbia, are still yielding well in our trials. Vicland has been a high-yielding variety, but because it is not safe from the new Helminthosporium disease, it is losing in popularity. Clinton, a recent cooperative development between the U. S. Department of Agriculture and the Iowa station, has consistently ranked among the high-yielding strains in our trials. It is recommended when seed is available. However, we have other strains of oats in our trials that consistently outyield Clinton, and these may soon be available.

Soybeans are grown in West Virginia first of all for forage production, and for this purpose we still recommend the Kingwa. For commercial seed production, where a yellow-seeded bean is needed, one of these varieties should do well—Lincoln, Chief, or Scioto.

Yield trials of seed collected by the county agents from farmers' seedstock have been conducted at Reedsville, Wardensville, and Kearneysville. These tests are carried out in order to give the farmers a chance to compare the crops from *their* seed, with crops from improved varieties. The winter wheat trials at Wardensville have been especially effective. More samples of Thorne wheat have been collected in that area since these trials were started.

Winter Barley Varieties Shown in Order of Yield at Five Experiment Stations Over a Period of 3 to 5 Years

Lakin	*Morgantown*	*Reedsville*	*Wardensville**	*Kearneysville***
Kentucky No. 1	Brier	Scottish Pearl	Kentucky No. 1	Scottish Pearl
Union	Kentucky No. 2	Kentucky No. 1	Brier	Brier
Smooth Awn 86	Scottish Pearl	Brier	Scottish Pearl	Union

* 3-year result.
** 4-year result.

Winter Wheat Varieties Shown in Order of Yield at Four Experiment Stations Over a Period of 3 to 5 Years

Lakin	*Morgantown*	*Reedsville*	*Wardensville**
Thorne	Fulhio	Trumbull	Thorne
Fulhio	Thorne	Fulhio	Nittany
Fairfield	Fairfield	Nittany	Trumbull

* 3-year result.

A Hybrid Corn for Each Climate

Corn is the most important cultivated crop in West Virginia, just as it is in the United States. It supplies, together with the hay and pasture crops, the bulk of the value received for livestock, dairy, and poultry products. In West Virginia we do not produce all of the corn that we use. If we are to have a prosperous system of agriculture, efficient production of this grain crop deserves our best attention. Increasing yields, due in large part to the growing acreage in hybrid corn, have permitted much of the poorer corn land to be retired. Such yields also have resulted in better land use and in increased soil conservation.

Corn breeding that will provide tested and adapted hybrid-corn varieties for our farmers is now, as it has been for some years past, one of the chief projects of the Agronomy Department. To date, six West Virginia hybrids have been released for production of certified seed, in cooperation with the West Virginia Associated Crop Growers and with the West Virginia Department of Agriculture.

The two hybrids most recently released may deserve special mention. West Virginia B-25 is an early midseason variety that has shown outstanding yield records in different parts of the state where corn of Iowa 939, or corn of slightly earlier maturity, is adapted to the growing season. Its stalk and grain characters have been highly regarded by the farmers who have grown it or seen it. This hybrid will be produced in greater quantity during the 1947 and 1948 seasons.

West Virginia B-29 is the newest of these hybrids, and a small amount of seed will be ready for planting in 1948. It is adapted to the longer growing seasons that are typical of the Ohio Valley and of the Eastern Panhandle counties, where it has performed well in comparison with other recommended hybrids.

J. L. Cartledge has been doing this work.

The Leaf Is a Factory for the Elements

In humid regions—like all of West Virginia—soils are naturally low in lime, humus, phosphorus, and sometimes potash. Of these, the low humus content is chiefly to blame for the low yields of crops. For the bulk of their nitrogen, these crops depend on the soil humus.

Now, there is some connection among three elements in the way they react toward each other in making plants grow. Potash and phosphorus have a way of making nitrogen carry out its obligation to the plant. To understand this relation, we have gone directly to

the plant—in this case, the corn plant.

E. H. Tyner has been analyzing the leaves of corn. The leaf is the factory where the plant makes sugars, starches, proteins, etc. In this way he hopes to learn how the plant performs when it takes in the different plant nutrients from fertilizers. He took the sixth leaf of many corn plants at shooting time, and analyzed these for the nitrogen, potash, and phosphorus in them.

Tyner finds a definite balance between nitrogen and potash intake of corn on leached upland soils. Put on enough nitrogen, but not enough potash, and your crop will not do all it can.

There is a balance, too, among all three fertilizers. Too much of any one of these will fail to pay for itself. But there's little danger that such will hap-

Close-up of eight blades of bluegrass affected with stripe smut. The fungus grows throughout the plant and breaks out in long black stripes. These are made up of masses of dark-colored smut spores. Leaves soon die and curl up like the two on the right. More than half the pasture can suffer when the disease strikes.

pen on most West Virginia farms. Cornland can take up to 500 pounds per acre of 10-10-10 before it reaches the point where cost exceeds returns.

If you want to fertilize your corn heavily, try it first on a small scale. The profit will depend on the amount of humus, on the rotation used, and on how much manure you apply.

A bluegrass plant getting a "shot in the arm" of spores of stripe smut. This treatment is given to large numbers of plants. If after some months the disease does not develop, we know we have a smut-resistant plant. It takes much time and patience to carry on research like this but the results we get are worth all it costs.

We Can Grow Mighty Good Red Clover

Some of our own home-grown red-clover seed does better under West Virginia conditions than any of the strains brought in from outside the state.

Since the South Branch Valley is our largest producing area, 31 samples of red clover seed were collected by Collins Veatch from farmers whose lands had been in production for at least five years. This seed was sown in plots at Morgantown and near Moorefield in the spring of 1946. Further seeding of these same strains is being carried on during 1947 at Wardensville, Moorefield, and Morgantown.

Stripe Smut of Bluegrass Can Be Conquered

Among many selections of Kentucky bluegrass, three strains of promising growth characteristics have proved to be very resistant, if not immune, to stripe smut. These strains are being propagated by clone and by seed. Further tests will be made on them as soon as a large enough area is under production. Collins Veatch is in charge.

An advanced alfalfa nursery also was

planted on the Agronomy Farm at Morgantown with seed furnished by the United States Department of Agriculture in the spring of 1946. Veatch is taking records of yields and other notes on how well these strains are adapted to home conditions. Since 1946, a collection has been started of healthy plants from old alfalfa fields. The best of these plants will be propagated by clone, then transplanted to the field for further selection and study.

Tobacco Is a Hungry Crop

Tobacco yields, in tests by T. C. McIlvaine and G. G. Pohlman, have been set largely by how much nitrogen is applied in the fertilizer. They have compared different rates of this fertilizer up to 50 pounds per acre in a tobacco, wheat, clover rotation. There were no signs that the 50-pound application lowered the quality of the tobacco. The looks of the plants indicated that this amount was not enough under the conditions of the test. Now they are stepping up the amount of nitrogen to try to find what is the amount we need for maximum yield. Effects from phosphate and potash fertilizers were much less evident than from nitrogen, but we did get our greatest yield from the highest rate of application of a complete fertilizer (5-10-10).

New Pastures from Old

On areas where the native growth is largely of poor-tasting grasses and weeds, tillage and reseeding will fully repay their costs in two years or less. We usually had heavier yield the first year, even if there was little to pasture in early summer and right after tillage. The midsummer and the fall growth was greater enough on the reseeded area to outyield the old pasture—and this growth came at a time when it was most needed, like a rain after a dry spell.

We have found that shallow tillage, using a disk or springtooth harrow or shallow plowing, is better than ordinary plowing in two respects: (1) We get more legumes. (2) We have less erosion. Tillage is most easily done in late winter or early spring, when the ground is heaved and wet. It does not seem harmful to shallow till when the ground is too wet for normal plowing.

Several mixtures of grasses and legumes have been tested—and most of them have been successful. Where bluegrass and white-clover pasture is wanted, these should always be included. Also, it is usually desirable to include some taller and faster growing grasses and legumes like orchard grass, rye-grass, and alsike clover. Ladino clover didn't stay in under ordinary pasture management, but it was very valuable where grazing could be controlled.

There is a decided advantage to limiting the grazing during the early period after seeding. You can do this to some extent by manuring the newly seeded areas. This control is especially important when the reseeded area is in a larger pasture. The livestock always reach for and overgraze the new seedings and bypass the old pasture.

R. M. Smith, F. W. Schaller, G. G. Pohlman, and D. R. Browning are our experimenters.

It Pays to Fertilize Pastures

Lime and phosphorus—these are the standbys that will give your pasture the chance to turn a profit. But nitrogen and potash may give good returns, too. F. W. Schaller, G. G. Pohlman, H. O. Henderson, and R. A. Ackerman found this to be true when they fertilized the pasture on Reymann Memorial Farm in Hardy County.

The value of the increase in total digestible nutrients they found by comparing it with alfalfa hay. The price of alfalfa hay was given as $20 per ton. The annual net profit per acre for the use of lime and fertilizer gave a return ranging from $1.98 to as much as $12.69 over the cost of fertilizer and the cost of applying it. In every case, the value of the higher production was greater than the cost of the fertilizer *and* its application. These experiments were conducted on strongly acid Monongahela silt loam soil (pH 5.0).

Permanent Pastures Need More Phosphate

Improving permanent pastures with lime and superphosphate is one of the most profitable undertakings on our West Virginia farms. In the past, many farmers have been content with using lime and 400 or 500 pounds per acre of

A typical poor pasture. No lime or superphosphate was applied here.

Good management, plus enough lime, plus proper fertilizer, gives stock the chance to thrive on pasture.

superphosphate as the first treatment. Studies by F. W. Schaller now show that 800 pounds per acre of superphosphate can give yields twice as high as where 400 pounds is used. Not only that; the feed also is better because bluegrass and white clover comes in thicker and faster.

When lime is applied to a pasture in the right amounts, as called for by a soil test, it will usually last 8 to 10 years. Superphosphate, however, must be applied *at least every four years,* to maintain yields and to keep clover in the pasture. It appears that a good plan is to use 800 pounds per acre of superphosphate for the first treatment, and then apply at least 500 pounds every four years thereafter.

Nitrogen and potash fertilizers are not generally recommended for West Virginia pastures. These fertilizers are expensive and often the response is small. Some farmers, however, are finding that they pay, especially where soils have been well limed and fertilized heavily with phosphate. Experiment Station studies show that nitrogen is most profitable when clover content is low. Potash response is greatest on highly leached and on light-textured or sandy soils.

Eight Million Tons of Lime!

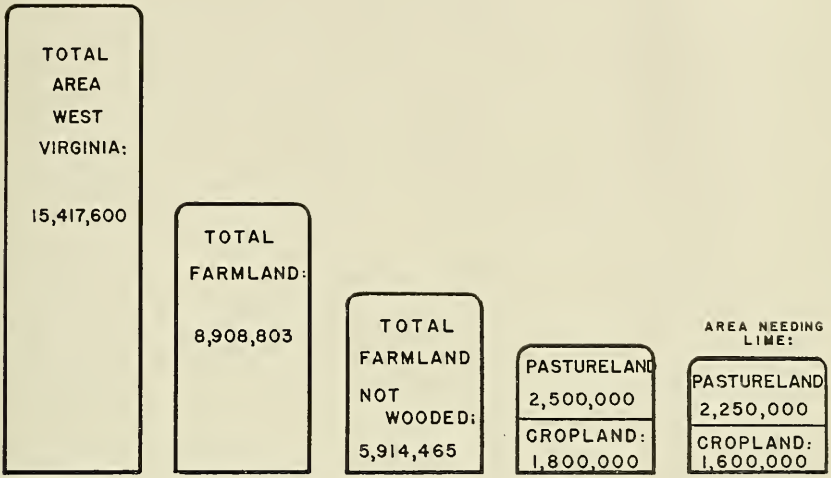
There has been a marked lessening in the lime content of nearly all of the agricultural soils of the state. C. E. Stockdale and W. W. Armentrout estimate that it would take *eight million tons* of limestone to satisfy our soils. There are 1½ million acres of cropland and 2¼ million acres of pasture land still worthy of saving.

On top of the eight million tons, 600,000 tons is needed to replace yearly losses. At present prices, the big application would cost about 33 million dollars, and the annual ante, 2½ millions. I wish our lawmakers would come to realize the extreme importance of these facts.

The need has been here a long time, but little progress in the use of lime on soils was made until the coming of the Agricultural Adjustment Agency. The AAA set up a program of supplying lime in place of cash payments for carrying on approved agricultural practices.

It is not at all likely that enough lime will be applied to the soils of the state, if all the cost must be met out of the small current income of the farms of the state. *If society needs to preserve the productive capacity of the most of West Virginia's soil, as well as the nutritive value of the food and feed produced from the soil, it will need to pay a large part of the cost of the lime.*

Oh, for a plan to heal these ruined hills!



This chart has much to tell about West Virginia's land area.

The Long Climb Back from Erosion

Our agronomists and our foresters have been studying eroded soils and subsoils. Generally speaking, they find five things wrong with such soils—

(1) Nitrogen and organic matter are low.
(2) Soil structure breaks down fast under cultivation.
(3) Run-off is rapid and loss from erosion is likely to be high.
(4) The supply of phosphorus is usually low.
(5) Potash may be short on some soils.

In 1939 we started field studies on an eroded area near Wardensville in Hardy County, and since then in other parts of the state. In all trials we have found that erosion can be controlled with a proper cover. This calls for seedbed preparation, liming and fertilizing, seeding adapted mixtures of grass and legumes, and controlled grazing or limited clipping.

A disk or springtooth harrow does well for preparing the seedbed. Plowing, if any, should be as shallow as possible. Deep plowing encourages erosion.

Most subsoils need lime for the right grasses and legumes. This takes 2 to 3 tons of ground limestone per acre. Also, it is best to use a complete fertilizer. We have found 500 pounds of a 4-12-4 mixture very effective.

As to grasses and legumes, we have had fair to good success from birdsfoot trefoil, lespedeza sericea, Korean lespedeza, sweet clover, alfalfa, and ladino clover. Promising grasses are weeping lovegrass, orchard grass, tall oat grass, redtop ryegrass, and even bromegrass.

Overgrazing, as I said before, is bad for any young stand of grass.

Several species of trees which seem likely to survive on eroded soils are under test at Wardensville. Some are hybrid poplar, Carolina poplar, green ash, and shortleaf pine, as well as mix-

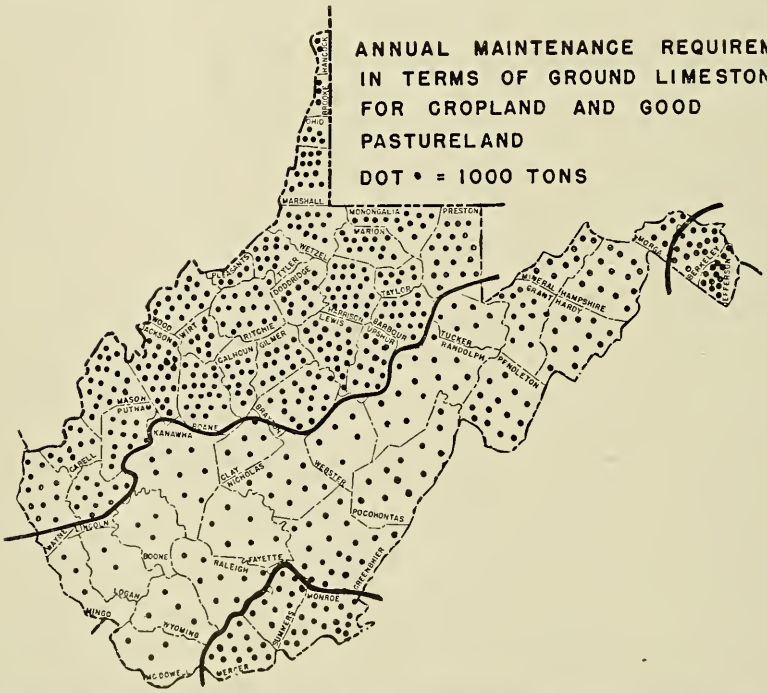
tures of black locust/black walnut and black locust/red oak. The better survivals are with black locust/black walnut, black locust/green ash, and green ash only. Black locust is growing better than any of the other species.

In trying to bring eroded soils back into production, we must remember that we are dealing with soils that have been badly damaged. They will need extra care for some years before they can be managed as normal soils again.

The workers on this long-time project are G. G. Pohlman, R. M. Smith, W. M. Broadfoot, D. R. Browning, and H. D. Erickson.

Subsoils Don't Behave Alike

There are great differences between topsoils. By the same token, there are great differences between the subsoils which lie below these topsoils. These differences are recognized by giving soils names which we will call "soil series." The series vary from one another in color, structure, humus, fertility, drainage, depth, and reaction to mechanical or to chemical action. The differences *between* series are usually much greater than those *within* a series.



Sections most in need of lime in West Virginia are three: (1) 2 counties in the Eastern Panhandle; (2) 3 or 4 counties along the southern border; (3) about 28 counties in the northwest part.

It is a long story, this technical and far-reaching investigation of the soils of West Virginia. Three agronomists—R. M. Smith, G. G. Pohlman, and D. R. Browning—are working on each of the factors mentioned. At this stage of the project only a few observations are in order.

Soils vary widely in their ability to absorb water and to permit its passage through them. Some will allow fast infiltering and drainage; others take water slowly and so may stay wet and poorly drained. Such soils are usually ripe for severe erosion.

In most surface soils, water movement is faster than in the subsoil. When the structure of this subsoil gets poor, water movement is slow and we have—a poorly drained soil. Our thought here is that deep-rooted grasses and legumes could use some of the excess water. Liming and fertilizing would be necessary first, however. Tillage is no help here because it destroys the humus and so makes the soil structure even poorer.

Will Strip-mined Lands Produce Again?

Strip-mining of coal is not new. It was practiced during World War I, but on a very much smaller scale.

Today it's a different story. Some 30,000 acres are affected by strip-mining in West Virginia. That is a lot of land in any state. Some of it is permanently out of agricultural use for tillage.

A law passed in 1945 required the operator to regrade spoil areas, but only where crop or pasture land had been stripped. The same law required him to seed or plant strip-mined areas into protective plantings, no matter how the land had been used before. The 1945 act also made the Experiment Station responsible for making proper recommendations to operators.

What happens to the land from strip-mine operations is not all good. Neither is it all bad. For instance, the broad terraces formed by regrading and leveling make ideal set-ups for operating farm machinery. On such sites, forage grasses and legumes can be grown for pasture or hay. On the other hand, because spoil contains almost no humus, it will be a long time before corn, oats, or wheat can be produced.

The problem of getting grass and clovers to grow on spoil varies. Our research workers recognize 3 different types of spoil: for example, acid spoil, sweet spoil, and spoil which is neither acid nor sweet (intermediate spoil). The acid spoil is the hardest to handle. Experiments indicate that such spoil should lie idle for 2 to 3 years before any attempt is made to plant. This spoil should then be limed with 3 to 5 tons of limestone, treated with 8 loads of manure, and with 500 pounds per acre of superphosphate. This should be worked in with a springtooth. When treated this way one can grow quite a variety of pasture and hay plants. Alsike clover, white clover, red clover, hop clover, birdsfoot trefoil, Korean and sericea lespedeza, as well as rye grass, timothy, and orchard grass do quite well. Grasses alone do not do well, and the area should not be grazed or cut the first season.

No lime is necessary on the sweet spoil or on spoil which is neither acid nor sweet. This spoil should be worked with a springtooth. In addition to the clovers and grasses mentioned above, sweet clover and alfalfa may be tried.

All legumes should be inoculated before seeding. That's important.

ORCHARDS AND GARDENS

There's Profit in Apples—If!

We have reached the end of a detailed study of the costs of running an apple orchard. M. A. Abrahamsen was the leader in this project and he was aided by R. S. Marsh, C. F. Taylor, and W. W. Armentrout.

Apples are the most important cash crop in this state. For the four years covered in this study, apples accounted for more than 8 percent of the cash farm income. They represented an average yearly sum of 3½ million dollars and made up about 30 percent of the cash income from all crops in the state. Hence we felt that it would be very much worth while to investigate the costs of producing and marketing them.

The study brought to light certain trends in the industry. I think it would be well for growers to be aware of these trends, if they are planning new work.

There has been a marked drop in the number of bearing apple trees, both in West Virginia and in the United States. Along with this, commercial production has become specialized in favorable regions of the country.

Returns from apple production are closely related to consumer purchasing power. This suggests that growers have an unusual interest in the general economic welfare if the latter makes for heavy buying.

Foreign trade in apples was an important factor in the apple market during the period between World Wars I and II. Apple growers may need to develop this market all over again.

Many costs of producing apples are more or less fixed, no matter how much they yield per acre. In the profitable orchards studied, high yield was common to all. It was only in very exceptional cases that yields of less than 200 bushels per acre gave a profit to the orchardist.

Yield on limestone soil was somewhat higher than on shale soil, but it is possible, with superior management, to show very creditable performance on good shale soil. Shale soils are usually cheaper, costs of spraying in orchards on shale soils are usually lower, and more of the fruit is of high quality.

Some growers believe that Hagerstown limestone soil is superior to Frankstown limestone soil for profitable orcharding. Our study failed to prove it.

Color and the Apple

Sixteen years long our chemists have been studying how color gets into the apple, and on the apple. The experiment began when bushels of Winesap apples were brought into the laboratory and peeled. The peelings were boiled down and down (I still remember the aroma) until very little was left. This was studied with chemicals. Finally, I. J. Duncan and R. B. Dustman were able to tell exactly what made up the coloring matter in the skin of the apple.

Next they went out to the field. With a carefully thought out spray program

they sprayed the leaves of trees with a chemical that brings out the red coloring matter. The trials worked and they were able to add color to the apple with the right sprays.

In any such attempts to change nature's methods, it is well to make sure that no harmful effects follow the new practice. That is why Dustman, with the help of C. A. Flanders, now is putting the color sprays to new tests. They are studying the inside of treated apples for make-up, for sugar content, and for keeping quality.

Is There Healing in the Apple?

Children afflicted with stomach disorders such as diarrhea have been cured with raw apple or apple powder. The treatment is quite simple. Apples—mellow apples—are peeled, cored, and grated into apple pulp. It takes 3 to 12 apples of medium size daily, depending on the size of the youngster. Apple pulp, plus weak tea, is given for two days, as much as the child will take. Nothing else. The pulp passes through the intestines seemingly unchanged and emerges in the stools as a spongy mass.

The experimenters—A. H. VanLandingham, C. E. Weakley, Jr., Paul Lyon, and R. S. Marsh—believe that several factors come into play in making this remedy work. The apple pulp cleanses the intestines and at the same time *removes the poisons*. Tannic acid and pectin are present in the pulp. They help. Then, too, the intestinal flora and the acidity of the intestines undergo a change. (And I have an idea that the fasting that goes with the cure has much to do with it.)

Our researchers have worked with white rats as well as with children. They found that raw apple, apple powder, and apple pectin brought about an increase in the acidity of the caecum and of the colon of rats. But these items had to be fed in considerable quantities. To judge from these results, it would seem that an apple a day is not enough to improve the health of man. It takes a lot more.

Weeds Crowd Legumes out of Orchards

The ideal soil cover in the orchard is a sod of bluegrass or legume, minus weeds. Yet how seldom is that ideal realized!

It is almost impossible to get a pure stand of slow-starting legume in a young apple orchard on fertile soil, unless you get a fair degree of weed control before the legume is seeded. Before they seed, one has to mow the weeds at least twice, for one or two years, before any legumes are sown. Even with a bluegrass sod, it is very helpful to clip the weeds once or twice during summer.

Weeds will continue to be a problem even where mulch is used with bluegrass sod in a fertile orchard. A heavy mulch can keep the weeds down under the tree spread, but beyond that, where the mulch stops, the weeds will take over. And a power mower around the edge of the mulch ring is no help. (Mow by hand? Excuse me!)

At Kearneysville, R. H. Sudds and G. G. Pohlman tried to encourage the growth of legumes and nonlegume sods in orchards. The soil there is not low in potash, and additions of that fertilizer have yielded no practical benefits. The weeds whipped the legumes before they could get established as pure stands.

The researchers report that crown vetch has been dropped as a sod-maker. Ladino clover has good characteristics, but it may need reseeding every four or five years. It is no match for either weeds or bluegrass where nitrogen has been applied under the tree, but it *will* take some shading. The Cumberland mixture of red clover has real possibilities. So does yellow biennial sweet clover. These two, along with crimson clover, tend to reseed satisfactorily.

It's an uphill struggle, this weed problem.

They Bow to the Wind

So many of the apple trees worked on clonal rootstocks bow to the wind—or, rather, away from the wind. R. H. Sudds has seen that in many tests at Morgantown and at Kearneysville in Jefferson County. Either the tree may blow over completely, or the top may lean heavily, with or without root breakage. The soil may be soft and wet, or it may be firm, with the roots well anchored in it. Just the same, even a moderately hefty wind may cause the trees to lean that stand on clonal stocks.

York Imperial, Gallia Beauty, Staymared, and Starking—these old standbys are usually on seedlings. But interest is shifting to seedling rootstocks of certain maternal parentage—among them Jonathan, Northern Spy, and McIntosh.

The old French crab has a very poor record. Judging by its record at Kearneysville and elsewhere, there is no reason for importing this seed any longer. Winesap, Delicious, and Rome Beauty are the chief varieties of the Northwest from which seeds are bought for rootstocks. But even these generally have made trees inferior to trees from Jonathan and Northern Spy seedlings.

DDT Put Codling Moth out of Business

The codling moth has been one of the most destructive insect pests of the apple industry. Year after year we have had to tell the same story.

At Kearneysville, in Jefferson County—the home of the University Experiment Farm—Edwin Gould has been testing many new insecticides and combinations, ever since the farm was established 16 years ago. Our hope has ever been to develop more effective, practical schedules for the control of this pest. Many other experiment stations and commercial research agencies have been doing the same. During that time, much progress was made. Instead of looking for outstanding new insecticides, we tried to improve the known methods of control. Bigger and better spray equipment appeared on the market. We also used more frequent applications of spray, and put more material on the tree. We put on all that the foliage and the fruit could take.

In spite of all this, the losses from codling moth were gaining. By 1944 that insect had become the limiting factor in profitable apple production through much of West Virginia. By then, much of the apples produced in that year was of such poor grade that it wasn't fit for the processing plants.

THEN CAME DDT!

The discovery of the killing properties of this insecticide was a most important one. It is the most effective and practical killer ever tested on codling moth in the Kearneysville orchard. By

now, from what we learn from our experimenters in the past three years, DDT can write off the codling moth as a major pest in commercial apple production.

DDT has proved its outstanding worth against many other important insects. Fruit pests yielding to its control are the pistol case-bearer, the leafhopper, the Japanese beetle, the oriental fruit moth, and the peach-tree borer. These are major pests, and there is a parade of minor insects which can be controlled with the same material.

Since our results, like those of others, have been so striking, we have been looking for more effective ways to apply the insecticide to all these pests. So, in 1946 we tried concentrated sprays, in contrast to the costly and time-consuming methods depending on water as a carrier. Results to date are most encouraging and give much promise for future development.

In the meantime, we are studying other insecticides for other pests. Benzene hexachloride looks promising in controlling plum curculio, an important pest of the peach industry. This new material is not harmful to the foliage or the trees, and is unlike arsenate of lead in that particular. Also, it gives effective control of grasshoppers.

Then there is hexaethyl tetraphosphate. This is one of the most poisonous insect killers ever tested at Kearneysville. It promises to be very useful in controlling European red mite, red spiders, aphids, grasshoppers, and the like.

NOTE: This material leaves poisonous residues and it is dangerous to handle. It must be used with extreme care.

Cherry Leaf Spot Responds to Fixed Copper

The Agricultural Extension Service has been relying on the Experiment Station's research for a workable spray schedule for sour cherry. Since 1939, studies by C. F. Taylor have proved their worth, especially in the severe outbreak of leaf spot in 1945. In that year a schedule of lime sulfur in the first two sprays, followed by fixed copper in all the later sprays, gave excellent protection. In contrast, orchards that received the old all-season lime-sulfur sprays lost all their leaves by June or July because of leaf spot. The same thing happened to cherry orchards where the new, recommended schedule came "too little or too late." This early loss of leaves was followed by injury which ranged from fewer fruit buds on some trees to death of the whole tree by spring of 1946.

After the 1946 harvest we made a very careful survey of most of the sour-cherry orchards in the Eastern Panhandle. Ten orchards had enjoyed excellent control of leaf spot and in the next year their crops returned, on the average, $1,297 per acre. On the other hand, in three orchards receiving no control, all of the trees were dead by spring 1946.

In orchards where there was only partial control of leaf spot, a few trees died. But in the remaining trees, production suffered from death of branches and from the smaller number of fruit buds. Gross returns were only $563 per acre.

In gross value of fruit and in the investment worth of the trees which were killed, 10 growers lost $121,000 because of poor control of leaf spot in 1945. In contrast, in 10 orchards where recommended practices were followed, no loss took place that could be measured.

In the eighth year of a test on sour cherries, orchards sprayed with fixed

copper averaged 47.7 pounds per 9-year-old tree. Those sprayed with the old schedule of lime sulphur averaged only one-fourth pound per tree.

But Sulfur's Still Standard on Apple

Most of the promising organic fungicides have been tested by C. F. Taylor to see how well they would do in the control of apple scab. So far, none of these materials has equalled in effectiveness the sulfur schedules now recommended. However, some of the newer materials are not so harmful to the leaves, and what these bland materials will do to succeeding crops cannot be foretold accurately. It will take more time to find the proper place of organic fungicides in the apple-spray schedule.

* * *

Let's see what's wrong with peaches.

Most, if not all, of the ugly cankers on peach tree branches, which have been causing peach growers so much trouble, are due to acid lead arsenate in the spray schedule. By increasing the amount of zinc sulfate in the spray mixture, and by taking care to make sure it is well dissolved, we have markedly lessened the injury that arsenic compounds can do to branches. Zinc sulfate was more effective than two proprietary substitutes in neutralizing the harmful effects of lead arsenate.

Bark Disease Indicates Too Much Manganese

Internal Bark Necrosis (Apple Measles) has been perplexing the scientist as well as the orchardist for some time.

Some scientists have believed that lack of boron in the soil was the cause. But since 1939 Anthony Berg and Genevieve Clulo have been studying the disease from all possible angles.

What they did find apparently had nothing at all to do with boron or its lack. Instead, they found that apple trees afflicted with this disease had much more *manganese* in their system than healthy trees did. What's more, the disease is most common where manganese and iron are kept in solution in the soil. Besides, when fertilizers with an acid residue were applied to such soil, the amount of the disease increased, and it became more severe.

Experimentally, our researchers have developed measles in apples trees by applying manganese heavily to healthy soil. They also prevented it by adding lime.

This disease is most severe on Red Delicious. It seems to be caused when manganese and iron are not in balance in the tree.

The Fight Against Root Rot

Treating the soil with fungus-killing chemicals has given promising results in the control of black root rot of apple. That disease is responsible for the death of many apples trees, and it can survive for years in infected roots in the soil. Trees planted in *treated* soil in infected areas in 1941 have escaped infection so far. However, we must wait until the trees are several years older, before we can draw final conclusions. More experimental plots are treated each year by C. F. Taylor, who is leading the fight against the disease.

We Are After High-quality Potatoes

We look for a potato with ability to grow and ability to withstand climatic extremes as well as disease. We haven't found it yet, but we are on the way.

During the past two seasons K. C. Westover has been working with 17 family lines. These represent some 4,000 stocks sent to us by cooperators at the Beltsville, Maryland, research center of the U. S. Department of Agriculture. Also by the Minnesota Experiment Station. From these families he made 132 selections. Then he added 103 samples of single tubers from numerous sources, tested all 235 in 10-hill and 4-hill plantings, and checked them closely with Irish Cobblers and Smooth Rurals. Fifty-four selections survived these trials. These were grown in single-row plots of 50 feet each, and checked again with the standard varieties.

These plantings do two things for us: (1) We can study the selected stocks closely. (2) We also can repeat the plantings until we have a small crop that can be studied for resistance to disease.

Cobbler on the left, very susceptible to scab, and Menominee on the right, resistant to scab. Latter variety introduced by U.S.D.A. Both grown in infested soil.

By now the field has been narrowed down to about 13 stocks and of these, a seedling from North Dakota and another from Beltsville showed promise. They were vigorous. They seemed to be well adapted to the middle altitudes. And they were somewhat resistant to drought, hardy to insect ravages, and at least as early as Katahdin. These tests were conducted at Reedsville in Preston County. In yield the two compared fairly with our usual named varieties. And they may have value on higher land, where most of our varieties are still immature at harvest time.

In the order of yield come the named varieties: Sequoia, Smooth or White Rural, Chippewa, and Houma. Sequoia is subject to soil rots and seems to be losing ground in the trade. Chippewa and Houma don't yield heavy crops too regularly. The Chippewa takes a light, fertile, well-drained soil and wants its rainfall well distributed. Houma seems to be hardier toward drought and seems to be suited to the middle altitudes in the state. But all these named varieties have some drawback, and so we hope that one of the new selections will outshine them all.

And Scab-resistant Spuds, too

Farmers who have the problem of too much scab in their best potato soil can try two new varieties. Released recently by the U. S. Department of Agriculture, they have been tested in West Virginia by J. G. Leach and J. R. Vaughn. These two, Menominee and Ontario, are late varieties that give good yields of scab-free tubers in a very heavily infested soil. Farmers troubled with potato scab should try these varieties on their infested soil.

Where Do You Put Fertilizer for Potato?

Does it make any difference where you put the fertilizer around those potato plants? K. C. Westover has been working on this question with the two standby varieties—Rurals and Cobblers. He used the "Hi-lo" system of applying fertilizer and compared this with the standard method. In all treatments he used the same amount of fertilizer, by machine.

Under the Hi-lo system he put one-fourth of the fertilizer in a band even with and 2 inches to the side of the seedpiece. The remainder, or three-fourths of the dose, he put on the opposite side, 2 inches from the potato and 1 inch *below*.

The second Hi-lo treatment was the same except that he split the amount of fertilizer half and half. Then for a check treatment he put equal amounts 2 inches on each side and 1 inch below. (That is the usual practice.)

It is a little early to speak of positive results. Westover reports that there was a tendency for the Hi-lo treatments to yield more potatoes than the standard treatment did. Rurals fared better when unequal doses were used. Cobblers profited from the Hi-lo but whether the two sides received equal or unequal amounts didn't seem to matter.

He also included some experiments to see how bandwise machine application of potato fertilizer compares with hand methods. He tells me that the results weren't impressive in the short time the experiment has run.

New Organic Fertilizers for Potatoes

Reedsville, Preston County, was the site of tests comparing Curbay and Royster mixtures in their effect on potato yield. Curbay, containing byproducts of the sugar-beet industry, was furnished by the Crop Protection Institute. Royster was an ordinary commercial with the usual organic and inorganic make-up. It can be bought on the local market. Rurals didn't show much difference between the two fertilizers, but Cobblers seem to favor the Curbay mixture.

Greater Yield Follows Full Cover

Sometimes the question comes up, Should potato seedpieces be left half uncovered at planting time? In 1945 Rural Russets were used, and in 1946, both Rurals and Cobblers. Both methods —shallow and full cover—were applied.

K. C. Westover observes three results: (1) Both varieties responded the same. (2) Shallow covering resulted in a somewhat better stand; but (3) Greater yield follows the full covering.

Keep Your Potatoes Covered with Sprays, or Else!

The earlier you start neglecting your potato vines, the smaller will be your crop.

K. C. Westover found this out in an experiment in which he did two things: he cut all the tops from half his plots. The other half he left untouched but he protected them with complete pest control. Smooth Rural was the variety.

Let me explain. He first planted a large area to potatoes. Beginning on July 25, when the plants were 87 days old and in full bloom, he started cutting the tops off the plants of a definite number of plots. Eight days later he did the same to another batch of plots. And every eighth day from there on, until harvest on October 6, he did the same thing.

Why did he do this? Simply to reproduce the conditions that might be expected when insect pests destroy an unprotected potato patch at different times of the season.

The tubers from the plants of the defoliated plots "cured" in the soil for 16 days. Then he dug, sized, and weighed them. The yields from the different sets of plots were then compared.

Results? Westover reports that the crop from the plots which grew the full season averaged 346 bushels of No. 1's to the acre. But the crop from the plots that were defoliated right after full bloom on July 25 netted him only 62 bushels. By cutting eight days later, early August, he got 75.6 bushels more. The average increase in yield till season's end was about 47 bushels to the acre each 8 days, but the gains thinned out to a mere trickle in early September after a long dry spell (10 bushels).

Now, the lesson from this is plain. Potatoes are made fastest during and soon after full bloom. That's when the tops do most of their work. If insect pests and diseases are allowed to destroy the tops, the effect is the same as if you cut off the tops yourself. Either way, the

tubers stop growing. They'll stop growing whenever the tops are done for.

Keep spraying your potatoes, and it won't happen.

Potatoes Respond to Radioactivity?

Another of our research projects deals with radium and its effect on potato growth and yield. K. C. Westover has been putting some radioactive matter into the soil, down to 7 inches, or plow depth, in preparing the soil for Cobblers and Rurals. The potatoes were planted by machine and the usual fertilizer was added.

So far, he finds no change between treated and untreated plants.

Blueberry on the Allegheny Front

Blueberries grow easily on the barren lands of the Allegheny front in Pendleton and Hardy Counties. When properly cultivated they can be made a profitable source of income, since there is a heavy demand for the fruit in the East.

By now we are past the first stage in our search for the right berry. We now have enough native plants to serve as parents in a vast breeding program. Almost 10,000 hybrids have been grown by R. S. Marsh and W. H. Childs from crosses between named varieties and the native plants. Of these, 2,500 have reached the fruitage age and only 20 of these were held for further trial. Some 7,100 hybrids, yet to fruit, have been moved from the greenhouse to the Horticulture Farm at Morgantown. Additional seedlings will be pricked off in 1947. We hope a few of these may prove to be better than varieties now at hand.

Blueberry seedlings have usually been grown in a sand-peat mixture, but our studies have shown that a season's growth in the greenhouse can almost be doubled when you use shredded sphagnum moss as a medium for the roots. A nutrient solution is of help there.

Our researchers are also studying the effects of environment on the rooting qualities of softwood and hardwood cuttings. They hope to propagate rapidly any new varieties that may be produced.

No End to Variety Testing

Variety testing of small fruits was carried on as usual at Morgantown by W. H. Childs.

Two new strawberry varieties proved worthy of further trial. Midland is a high-quality early variety especially desirable for home use, and Sparkle is a good late variety. Sparkle seems to be not quite as late as Redstar but may outyield it.

The Glendale gooseberry still is the best for yield in West Virginia. It is a slightly smaller berry than Poorman but has yielded almost twice as much. Plants should be set at least 7′ x 7′, since the bushes are very vigorous.

Athens, an early blue grape, and Bronx Seedless, a red and white midseason variety, are worthy of trial for the home vineyard. Athens may compete with Fredonia as an early commercial variety also.

Best Time to Remove Strawberry Mulch

Have you ever wondered how much you could increase your strawberry crop by holding the mulch on it late in the spring? We have, so we studied the matter in a preliminary way in 1946. The mulch on a planting of Premier and Catskill strawberries was removed from part of the field on March 25, and another part on April 11, and from the rest on April 25. W. H. Childs reports that yields for Premier were considerably better when the mulch was removed early, while for Catskill either the March 25 or the April 11 date was satisfactory. April 25 was too late to hold the mulch for either variety. The study will be repeated.

Fixed Copper—Lifesaver for Tomatoes

Late blight has become a very serious disease of the tomato. Year after year, heavy outbreaks have taken place in more and more sections of the state. Last year, garden growers in many sections suffered total crop failure.

The disease appears without warning and it spreads fast.

We have one control that really works. Our research has worked to our complete satisfaction. Fixed-copper dust, sprayed or dusted thoroughly, will give very effective control even when the disease is most severe.

Experiments made at Huttonsville by John R. Vaughn showed a threefold gain in yield of tomatoes dusted with a fixed copper as against plots which received no fungicide. Insects were controlled on all plots. To be effective, dusting or spraying must begin shortly after the plants are set out and must be continued every 7 to 10 days until harvest is done.

And if it isn't *tomato* blight, it's *potato* late blight. New chemicals to be used as sprays and dusts in the fight against this blight are some of the aims of J. G. Leach and J. R. Vaughn. DDT, you know, has proved itself very effective against potato *insects*. So now they are on the prowl for more effective and easier-to-use *disease* killers.

In experiments at Reedsville and Huttonsville, about 25 combinations of fungicides have been tested. The fixed coppers have proved to be as effective as Bordeaux mixture and they are easier to use. You can generally get them at your dealer's in both spray and dust form. Other chemicals which show promise are being tested in the field, and new materials are being added to our tests each year.

Successful has been the war-time search, by C. F. Taylor and J. A. Rupert, for materials to replace war-scarce heavy metals as seed protectants. One organic compound proved better as a vegetable-seed protectant than any chemical used before. It is on the market in quantity now, under the trade name "Arasan." Practically all who have used it recommend it highly.

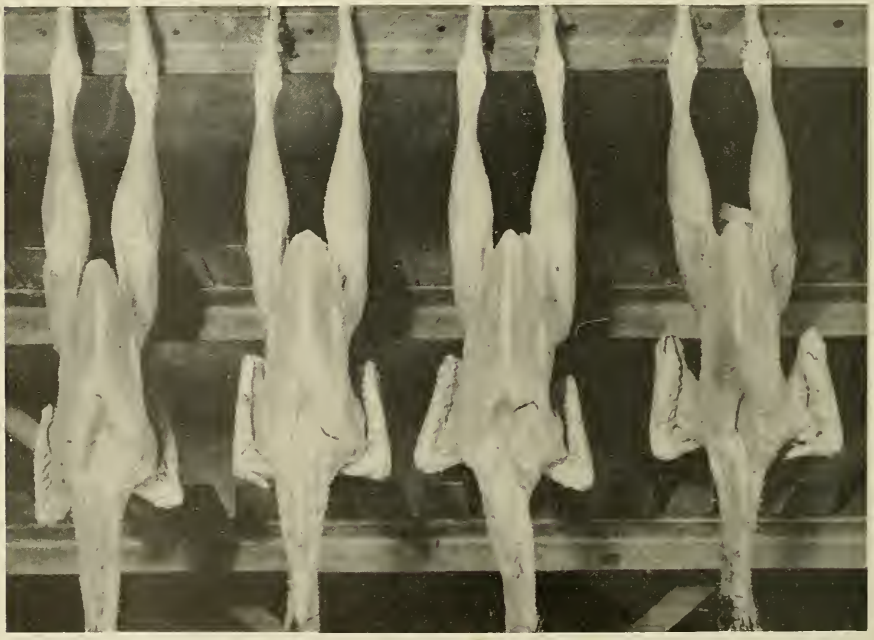
POULTRY

The Right Protein Level for Poultry

It is sound business to keep up the level of protein in the laying ration at around 16 percent.

T. B. Clark, T. D. Runnels, J. H. Rietz, and C. E. Weakley, Jr., have studied this problem for a long time, using altogether 1,480 White Leghorn pullets in 27 lots. They worked with two strengths of protein—13.5 and 18.5 percent—in both growing and laying periods. They also used two other levels —16 and 23.5 percent—in laying periods only.

These experimenters did not find the most satisfactory strength of protein for all conditions. But they did learn that, for best results, the protein level in the *laying* ration was more important than the level in the *growing* ration. For instance: 18.5 percent protein in the *laying* ration produced more eggs and on fewer pounds of feed than 13.5 percent produced. And it made no difference how strong the protein was in the *growing* ration. The chief point we want to make here is that, even if a low protein level should be fed in the *growing* ration, a higher protein strength, starting at



This broiler is too common and has little consumer appeal.

laying age, will give you satisfactory egg production. Of course, this means that you'll have fewer eggs at the start.

To get at the ideal of 16 percent protein, you feed equal parts of whole grain and a 20 percent protein laying mash.

Chickens Can Use Some Soybean for Protein

We are constantly after better combinations of protein that will assure us fast growth and efficient use of feed. Any developments here would count in broiler production.

A. H. VanLandingham, T. B. Clark, and B. H. Schneider have found that a good soybean oil meal is a satisfactory source of protein. But there is much difference in the quality of feeds; so the safe thing to do is to make some animal protein go along with the soybean source.

Some of our rations used in these trials had soybean oil meal alone for protein source. Others contained it plus meat scrap and corn gluten meal—in numerous combinations. That corn gluten has a favorable effect on skin color in chicks. Some research men in other states have reported, too, that corn gluten supplements soybean oil meal nicely for growing chickens.

Chicks were put through growth trials up to six weeks of age. We also employed body-use (metabolism) studies with chickens from 7 to 12 weeks old. There was good growth, and just

West Virginia poultrymen should breed for and produce more of this type of broiler with plump breasts and few dark pinfeathers.

as good protein use, whether we fed soybean oil meal alone, or when we mixed it with meat scrap. This meat scrap replaced one-fourth of the oil meal in one trial, one-half in another, and three-fourths in a third trial. It furnished supplementary protein to that extent. The cereal ration of ground whole corn, ground oats, and ground wheat supplied 8 percent protein in these trials, and the several protein supplements yielded another 8 percent. This made a total of 16 percent protein in the ration.

But when corn gluten meal was used to replace one-fourth, or one-half, or three-fourths of the soybean oil meal, the rate of chick growth dropped, and the percentage of protein use dropped likewise, according to the amount of corn gluten meal fed.

As I was saying—soybean oil meal is a good source of protein for chickens.

Good Broilers and Layers, too?

The income from broiler production in 1945 equalled the income from all other poultry sources in West Virginia, and on another page of this report our economists will have more to say about profits in this game. Right now we'll talk about the breeding of broilers.

T. B. Clark and C. J. Cunningham have been studying different strains of New Hampshire chickens. They are after a bird with outstanding broiler and reproductive characteristics. So far they have studied eight strains. The New Hampshires also have been crossed with Barred Rocks and with Dark and White Cornish to see what effect crossbreeds would have on broiler qualities.

I think it well to show the results by a table (below), and I suggest that you read it carefully, because the facts are there, and you can draw your own conclusions.

Here we compare six strains. Strain G is the result of the best birds in the so-called broiler strains, A and B, when crossed with those in the higher egg-producing strains C and D. You can improve your flock this way for a while, but continued improvement can be made only through selective breeding.

The Dark Cornish/New Hampshire cross proved to be as satisfactory as the Barred Rock/New Hampshire cross. Both crosses were better than the New Hampshire and the Barred Rock purebred broilers.

How Different Strains of New Hampshires Compare for Broiler Production

	YEAR							
	1944				1945			
STRAIN	A	B	C	D	E	F	G	D
Percentage, fast feathering—10th day	95	97	49	41	7	95	77	35
Feather grade—3 mos.	2.7	2.8	1.9	2.0	1.5	2.9	2.9	2.6
Breast grade—3 mos.	2.5	2.5	2.7	2.6	2.3	2.0	2.0	2.3
Average weight—3 mos. (lb.)	2.8	2.6	2.4	2.3	2.6	2.9	2.8	2.4
Egg production—10 mos. (%)	50.0	51.8	56.7	61.4	54.3	52.5	55.8	51.7

Feather grade—3, completely feathered.
Breast grade—1, highest grade.

My Message

The days pass, and the years pass. With them, humanity passes. So does the farmer.

The farm stays put.

Or does it?

Any land that is hilly, like ours in West Virginia, is subject to the whims of wind, and water, and weather. I need not labor the point. You can see the truth of that statement anywhere.

When I think of land, I think of the 100,000 farms within the borders of our Mountain State; and of the 9 million acres of timberland. I think of square fence corners on steep slopes, and washed-out hillsides, and weedy pastures, and thin croplands, and poorly managed woodlots, and scrubby creek bottoms, and muddy waters.

It was not always that way. There was a time when what is now West Virginia was an almost unbroken cover of trees. Only limited areas of the river bottoms were clear of forest growth. There was no erosion. The streams were clear and pure, and fish abounded. Wildlife was everywhere. Nature was in balance.

Now, I am not recommending that we go back to that early stage. There wouldn't be land enough to go around, for all our population. But I do wish to point out that farming as a profession will continue to go downgrade in this state *unless*—we restore in large measure the fertility of the soil; we promote a forest cover wherever the land is not suited to agriculture; we reestablish a degree of purity and clearness to our mountain streams.

But how?

Simply through a thorough and far-reaching program of research, coupled with a state-wide and county-wide service of agricultural extension. And this program must be carried to all the public, so that the people living in the congested cities and in the open towns may learn whence come their wealth and their health.

The reports that you read in this book will give you at least an inkling of how earnestly your College of Agriculture is working in your behalf and for the public welfare.

C R Orton

Crushed Limestone OK in Poultry Feed

There is plenty of limestone available in this state. Some of it has a high calcium content and it should be suitable for feeding poultry. Poultrymen have claimed, however, that laying chickens do not eat crushed limestone readily, and also that it produces shell of poor quality. T. B. Clark, H. M. Hyre, A. H. Van Landingham, and C. E. Weakley, Jr., have been comparing West Virginia limestones with other calcium carriers to find out if these claims have any basis.

In the laying trials, where both White Leghorns and New Hampshires were used, these experimenters found that crushed limestone was taken as readily as oyster shells. Three methods wer used for testing egg-shell quality; non of them showed that this limestone prc duced a poorer shell than either oyst shells or calcitic limestone. The varia tion in egg production from the differer lots so far cannot be charged to the ca cium supplements fed to the layers.

The results from other experimen stations suggest that a limestone con taining 90 percent or more of calciur carbonate should be used. In our trial we found no great difference in egg prc duction between limestones containin 85 and those containing 90 percent.

Grass Silage for Chickens Is Costly

Several years ago many poultrymen in West Virginia got interested in the feeding of unripe grass silage to poultry. Its helpful effects had been highly praised in the poultry press. So T. B. Clark, A. H. VanLandingham, and C. E. Weakley, Jr., made a study of the preparation and the feeding of this silage. Troubles in making it were readily overcome. By packing the silage in straight-sided steel drums and closing the lids tightly to shut out the air, they found that it could be kept without any preservative. Alfalfa, red clover, and immature cereal grains were used.

Chickens, two to six weeks of age, could not eat enough of this silage to prevent a lack of riboflavin, an impor tant vitamin. Likewise no helpful effec was noted when the experimenters fe silage to growing pullets from 8 to 2 weeks of age. And no effect was note on egg production when the silage wa fed at levels of 2.5 and 3 pounds pe 100 layers a day. When the feeding wa increased to 5 pounds, less mash an grain was eaten. Egg production drop ped, and more hens died. Hatchabilit varied so from chick to chick that th helpful results, if there were any, coul not be charged to the silage fed.

Grass silage is expensive to make. Th vitamins in it can be had more uniforml and more cheaply in other ingredients

What Family Selection Will Do

This experiment has been under way since 1938. H. M. Hyre and Dr. M. A. McHale have been choosing the birds for livability, high egg production, egg size, and other factors that make or break a business. These birds were selected fron families that had these desired charac ters. There were 648 pullets housed in

the fall of 1945. The mortality up to the following August was 7.2 percent. The average production, based on the original number of birds housed, was 229 eggs. In the year before, production was 217 eggs per bird, and 16 percent died.

Both egg production and livability in this flock have gradually picked up since the beginning of the project, when 34.4 percent of the birds died and when production was 175 eggs per bird. These results assure us that both production and livability of single-comb White Leghorns can be bettered by selection on a family basis.

What's the Score on Broilers?

Those broilers can make money for West Virginia farmers. Since 1939 the industry has grown fast, with 7,600,000 birds raised in 1945. Most of these were grown in Hardy, Pendleton, and Grant Counties.

More income has been earned this way by farmers, feed dealers, and handlers. It's getting so that many farmers just haven't any time left for anything else. J. H. Clarke's survey shows that in 1945 about three-fourths of the birds were grown on shares or contract.

Clarke has gathered facts on feed needs, on costs, and on mortality for 269 broods numbering nearly one-half million birds. And from their 108 producers he got information on costs for housing, equipment, fuel, labor, and so forth.

As the industry grows in importance, more facts will be needed by producers, so that they can do a more efficient job. Such information will be forthcoming in a bulletin now being prepared by Clarke.

Satisfactory Middle Sizes from Turkey Crosses

The growing interest in turkeys of middle sizes has resulted in many questions coming to us about crossbreeding. Producers of turkeys are concerned about the feather color and about the size of the offspring from different crosses. The research conducted by T. B. Clark and E. A. Livesay has given us the answer to many of these inquiries.

The bronze feather pattern is dominant to all other colors. When the Bronze is used as one of the parents, the general color pattern of the offspring is like that of the Bronze variety. Some brown or black or white may appear, depending on the feather pattern of the other parent. The table on this page tells the story simply. In size the crossbreds usually are halfway between the two parental varieties. However, in some crosses we have found that the crossbred toms were closer to the weight of the larger parent.

This particular cross is satisfactory for those wanting a bronze-colored turkey, middle in body size. Most of the offspring, however, have too much leg length in proportion to body depth, and they lack the blocky conformation of the Broadbreasted Bronze.

Average Body Weight of Purebred and Crossbred Turkeys at 28 Weeks of Age

	TOMS	HENS
Broadbreasted Bronze	24.1	14.4
Beltsville White	15.8	9.1
Crossbreds	20.2	12.2

How Best Sell Poultry and Eggs?

About one-third of the cash farm income of West Virginia farmers comes from the sale of poultry and eggs. As a rule, eggs are sold by more than half the farmers. But, since the flocks are small, little attention has been given to better flock management and to better marketing.

M. A. Abrahamsen finds that almost half of the yearly marketing of eggs takes place from February through May, when egg prices are lowest. In recent years egg prices in this state have averaged higher than United States prices during the fall and winter months, and lower during the spring and summer months. Improved flock management points the way to correct this situation, he says. Dealers in eggs claim that uncertainty of supply and poor quality are holding back improvements in the marketing system.

BEEF CATTLE AND SHEEP

Beeves Can Take Legume-grass Silage

After three years of trials E. A. Livesay, C. J. Cunningham, and A. H. VanLandingham have come to the conclusion that beef cows can be wintered well enough with a ration of legume-grass silage and legume hay.

Shade in the pasture makes for contentment. Contentment makes for profit.

In 1942, 30 heifer calves were divided into 2 lots of 15 each. One lot received corn silage and hay as a control ration and the other lot we fed legume-grass silage and hay. Each lot had the same amount of hay, which was kept constant, and the amount of silage was varied so that each lot would get the same amount of dry matter. Each lot has been fed on the same type of winter ration as it received the first year. The two lots were combined and pastured as one herd during each summer.

During this time they raised two crops of calves. The average weight of each crop at weaning has been slightly in favor of the lot getting legume-grass. The gain of the cows during the winter feeding has been about the same. No great difference in appearance of the two lots could be noticed at the end of the winter feeding.

The legume-grass silage was made each year without preservatives. We found that a high quality can be made from legume-grass in this way by wilting it until the moisture content is between 60 and 70 percent. When this goes below 60, mold is likely to develop. And if the moisture is higher than 70 percent, the silage is likely to develop an off odor. That's when the calves turn up their noses.

How about labor? It takes a little more man and machine hours per ton to fill a silo with legume-grass instead of corn. But, just remember how many hours of machine and man labor it takes to produce a corn crop! Filling the silo with legume-grass mixture can be done with fewer men at any one time. And it does not take a lot of expensive equipment to make legume-grass silage. All that is needed is the common hay-making equipment and the regular corn ensilage cutter.

Some 7½ tons of legume-grass ensilage was produced, on first cutting, to the acre. On comparable land the *corn* yield was 10 tons, true. But from the second crop of legume-grass the equivalent of 2 tons per acre of ensilage was cut for hay. On top of that, the same area gave pasture for 6 weeks during the late fall.

Do you wonder that our animal husbandmen are in favor of legume-grass silage?

Western Corriedales Have the Advantage

Grade Corriedale ewes bred in Montana are proving to be really profitable for wool and lamb production. Sixty-five of the grade Corriedale ewes, known as Westerns, are being compared with just as many West Virginia grade Hampshire ewes at the Reymann Memorial Farms. Results of the first three years of the research, carried out by C. J. Cunningham and E. A. Livesay, tell us that greater returns can be expected from the Western ewes.

During the first three years the 65 Westerns produced 1,909.3 pounds of wool for a return of $1,022.41. This compared with 866.9 pounds of wool, worth $469.68, from the Hampshires.

During this same period the 65 grade Westerns have produced 237 lambs, weighing 17,418.5 pounds, for a return of 2,391.77, while the 65 Hampshires produced 190 lambs, weighing 14,040.5 pounds worth $2,033.77. This makes the total returns for wool and lambs for three years from the Westerns $3,414.18 and from the Hampshires $2,503.45—quite a difference.

Both breeds are being kept together and treated as one flock, except during the breeding season. Internal parasites

are being kept under control with a mixture of 1 pound of phenothiazine and 9 pounds of salt, alternating each month with plain salt. This method of feeding phenothiazine has given us excellent control.

The Hampshires have produced 5 percent more choice and good lambs. This is to be expected because the Western ewes have more twins. The average weight of the lambs was just about the same for both groups at marketing. The Western ewes breed a little earlier. They are well adapted for producing early lambs.

The mortality has been about the same for both groups, being about 18 percent for the 3 years.

For Parasites, Give Them Salt-phenothiazine

For more than 18 years this Station has kept a flock of some 30 head of grade breeding ewes for research in parasite control. Throughout this period the flock was managed and experimental data were collected by Dr. J. H. Rietz and C. V. Wilson. Every year they bought flock replacements. These replacement ewes as well as the original animals always showed symptoms of parasitism as well as heavy ova count in their feces.

The pastures used by these sheep are considered to be infested heavily with parasite ova and larvae.

Many different drugs and combinations of drugs have been tried in the treatment of this flock of sheep. How-

Grade Corriedale ewes, Montana-bred.

ever, for the past 4½ years the treatment used has been only a salt-phenothiazine mixture in the ratio of 14 pounds of salt to 1 pound of phenothiazine.

The ova count in the feces has been lower with this treatment than with any other treatments tried. The condition of the flock is better than it was when other treatments were used.

Four crops of lambs have been produced from the ewes fed the salt-phenothiazine mixture. These lambs have reached market weight at a younger age than crops of lambs of earlier years that were raised under other methods of treatment.

Some 4 years ago the salt-phenothiazine mixture was adopted as the only parasite-control treatment for the 75 head of purebred ewes kept at this Station. The experimenters examined random samples of feces from the purebred ewes for ova. The count was either very low or negative. The general condition of the purebred ewes improved. The salt-phenothiazine mixture proved superior to any other former method of parasite control.

Examinations have been made of local samples and autopsies of sheep from many parts of West Virginia. These indicate that the same species of parasites found on the University farm are present in sheep flocks throughout the state. If other conditions such as feed and care are equal, then farmers throughout the state may use the salt-phenothiazine mixture for parasite control with full confidence that they will get similar results.

Grade Hampshire ewes, West Virginia-bred.

Feeds Differ Much in Digestibility

A book, "Feeds of the World, Their Digestibility and Composition," has been published by the Experiment Station. It carries accurate information on 1,200 feeding stuffs. Extensive tables tell what percentages of protein, of fat, and of each other nutrient are saved by the animal. The rest of the feed is of no value to the animal and is excreted in the manure. Feeds differ much in this respect, and this difference is of great economic importance.

The book gives such information for cattle, sheep, goats, swine, and horses. In all, 11,000 digestion experiments are arranged in averages. To get all this material together it was necessary to search through 2,800 scientific publications printed in 17 different languages. It took about 12 man years of work to do the job.

After the book was finished, B. H. Schneider, the author, and Helen Pavlech, together with other assistants in the department, have been trying to discover other useful information hidden away in this mass of data. Some of the questions they are trying to answer are:

Are the differences between certain feeds real and are those differences always true? For instance, between first, second, and third cuttings of alfalfa hay, *is* the second cutting the best?

Are the differences in the nutritive value between feeds, or between different lots of the same feed, caused by differences in the chemical composition?

Can we estimate what the feeding value of a feed will be from its chemical analysis and without animal experiments?

Do cattle digest as well as sheep, and *vice versa?*

Under what conditions does the efficiency of digestion change?

These are technical questions. The answers we get will help us—and all feed users—to understand more and more of the value of feeds.

Swift & Company have shown their interest in this work by continuing to give a grant-in-aid to help with it in each of these two years.

Professor Joel Axelsson of Lantbrukshögskolans Institut för Utfodringslära, Uppsala, Sweden, has shown his interest to come and work with Professor Schneider for one year. We hope for more of such international cooperation in agricultural science in the future.

DAIRY STOCK AND DAIRYING

You Should See Our Herds!

You've heard of the Experiment Station's herd of Ayrshire cattle and of its achievements. It is known far and wide —all over the world in fact. In 1946 this herd of 48 milkers smashed all its previous records and did it on a twice-a-day milking schedule. They averaged 9,858 pounds of milk testing 4.46 percent with 439 pounds of butterfat. One junior 3-year-old gave 11,656 pounds of milk testing 4.51 percent with 526 pounds of fat in 305 days. This makes her the tenth ranking 3-year-old Ayrshire of all time.

This herd also has been classified for

type by national officials of the breed. It ranks in the top half-dozen herds for good type conformation. And for the third year straight, the herd has been awarded the Constructive Breeder Award. This honor is given by the Ayrshire Breeders' Association for carrying out a program of breeding that has resulted in a combination of outstanding type and superior production. George Hyatt, Jr., replaced G. A. Bowling as project leader in February 1946.

Our Holstein herd has made steady progress and has finished with its best record in 1946. It made 11,606 pounds of milk testing 3.77 with 438 pounds of butterfat. This, along with excellent type rating, qualifies it for the coveted Progressive Breeders Award, the highest honor bestowed by the Holstein-Friesian Association.

The fine Jersey herd was hit hard two years ago by breeding difficulties that caused a considerable drop in production. This condition has been overcome and production is again returning to normal. The herd was officially classified for type in 1946 with a score of 0.842, which makes it one of the leading herds in the state. Both the Jersey and the Holstein herds are used in many feeding projects and demonstrational work.

All this progress has been achieved in spite of difficulties in getting the right kind of feed and satisfactory farm labor.

Portion of the famous Reymann Memorial Ayrshire herd as they return from pasture.

Should Dairy Cows Get Thyroprotein?

In my latest report I spoke of feeding two groups of Holstein cows with iodinated casein containing thyroid activity (thyroprotein). At that time our researchers fed two teaspoonfuls daily over a period of four weeks in a reversal feeding trial. In these short periods, milk production went up from 5 to 20 percent, and total fat production from 25 to 50 percent. This step-up in fat production came about by higher fat percentage as well as by the larger volume of milk.

Last year we fed this material to 6 cows—3 Jerseys and 3 Holsteins. We started feeding about the third month of lactation, after the peak of production, and continued the treatment for the rest of the lactation period. Three of these cows are now getting this materi for their second lactation period (1947)

Thyroprotein is a powerful ally. I causes an increase in milk productio and in the percentage of fat in the mil No change was observed in the othe fractions of the milk.

The heart beats faster, and so does th respiration rate. At the same tim marked decrease in body weight take place when thyroprotein is fed. That i why every dairyman who is thinking o using it should exercise great care. I will take several years of research to de termine whether harmful results follo its use.

A. H. VanLandingham, George Hy att, Jr., H. O. Henderson, and Charle E. Weakley, Jr., are the experimenters.

Heifers Grow During Pregnancy

Heifers in calf—do they grow any on their own? Dexter N. Putnam and H. O. Henderson have made a study of what pregnancy does to body weight. They kept records of 56 Ayrshire cows during the first three gestations and found that about one-half of the gain in first-calf heifers can be charged to growth and the other half to the products of conception.

The average permanent gain in weight of first-calf heifers was about 16 pounds per month, the gain being faster during the early months of pregnancy. The slower growth of the animals during the later months can be written off on the larger demands of the fetus for nutrition. During the second pregnancy the amount of gain in weight due to permanent growth was only 27 percent, and for the third pregnancy it was 20 percent. In both the second and third pregnancies this permanent gain in weight was distributed evenly through out the gestation period.

Like Youth, Like Maturity

Good proved sires are hard to get be cause of their high cost and because the are few in number. Hence most dairy men must rely on young bulls. This prob lem suggested to us that the herd—i this case the Reymann Memorial herc of Ayrshires—be divided into 2 groups A and B. Only young unproved sires ar being mated to Group A females, anc only good proved ones to Group B stock From time to time we will make com parisons to see whether the performanc of the A group will stack up well wit the B group. This refined system of se lecting bulls will take at least 10 year before we can expect any results of re liable sort.

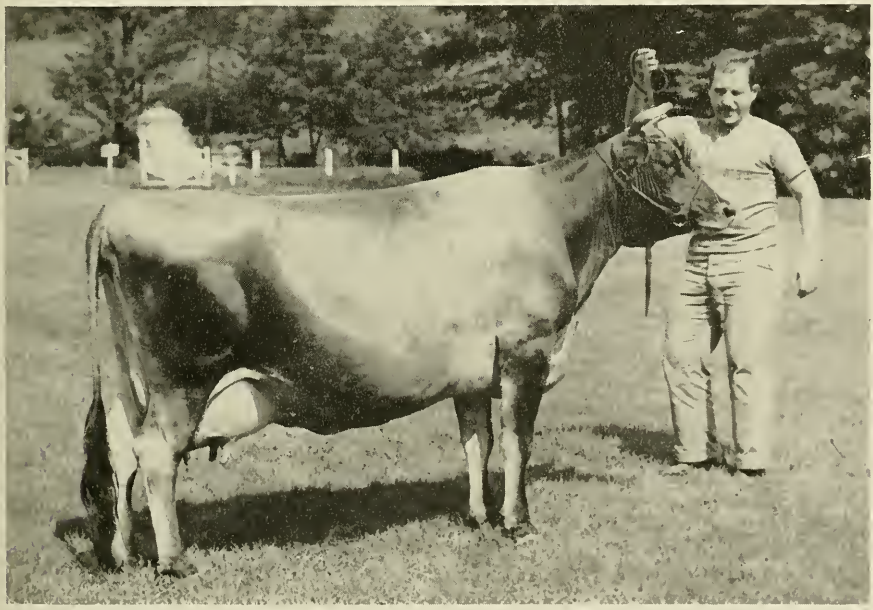
But we do have a branch of this project which shows results in shorter time. That is, classifying stock for type. Hyatt and W. J. Tyler have classified heifers for type, beginning at 6 months of age and every 6 months thereafter until age 4. Their final results indicate, without question, that what a young heifer looks like will be mighty close to her type after she becomes a milking cow.

This fact should give dairymen another valuable yardstick which can be used to help decide which heifers to save for breeding purposes. Certainly those in the lowest groups (the low "good" and "fair" heifers) are not likely to grow into the types of cows desired by most breeders. The sooner the breeder can cull these animals the faster will be the improvement in the type of his herd.

In Type and Production, They Take after Parents

More and more, the breeding of dairy cattle is being done according to scientific knowledge. If we want to know more about how production and type are inherited, we must study thousands of records. And here, your Experiment Station has ranked at the top in exploring this business of inheritance in dairy cattle.

Our research has shown us that type and production are passed on from parent to offspring. From this we conclude that improvement can be made in both type and production. As matters now



W.V.U. Bindle Fern, bred and exhibited by West Virginia University at State Dairy Show, Jackson's Mill, 1946. Senior Champion, she produced 8850 pounds of milk with 449 pounds of butterfat in 305 days at 7 years.

stand, however, in most herds there is not much connection between these two factors.

Just a minute ago I reported that the type of young heifers at 6 and 12 months of age is a good yardstick of the type the animals will be at maturity. Now I can add that the producing ability of young calves can be predicted from careful study of their pedigrees. This means that young heifers can be culled early for type and production, and this in turn would stop the cost of the feed and care to raise the "poor" heifers until they come into production.

Results also have shown that the production records of a cow are slightly more important than the average records of her daughters when it comes to predicting either the breeding value of a son of the cow or the production of a future daughter. However, this is true only when *all* the records of a cow are used, and not just the highest record. Of course, combining the average of the cow's records and the average of all her daughters is better than either one alone. W. J. Tyler and George Hyatt, Jr., are in charge of this study.

Prepartum Milking—Help or Hindrance?

A study of prepartum milking has been made by R. A. Ackerman, George Hyatt, Jr., H. O. Henderson, A. H. VanLandingham, and C. E. Weakley, Jr. "Prepartum" is the term given to the practice of milking before calving time.

No effects have been noted on the calves when they are given codliver oil to start them off along with the milk from their dams. Thirteen calves have been started by this method and have been compared with an equal number of calves fed from normal freshening cows. No difference has been noted as to growth and general health of the calves. But this is only a preliminary study.

A larger study is being started. It will include the effect of prepartum milking on the cow as well as the calf. And it will observe the changes that take place in the milk of cows that are prepartum milked *before* and *after* freshening, as compared with the milk of those that freshen normally.

How Long Will That Milk Keep Fresh?

People often wonder how long the milk in their icebox will keep without danger of spoiling. To calm their fears, S. J. Weese and H. O. Henderson have started a project to study the keeping quality of pasteurized milk in home refrigerators. Here's their method:

Ordinary pasteurized milk from the University creamery is delivered to home cooperators, who use about three-fourths of the milk. These cooperators after three to six days return the remainder to the creamery, where it is checked for flavor, acidity, and bacteria count. Likewise, some of the fresh milk is checked at the time of delivery, and any changes are noted at intervals from three to seven days after delivery.

Our work so far indicates that milk can be kept up to four days in home refrigerators under normal conditions, without much change in flavor, acidity, and bacteria count. But we still have a long way to go before we can make positive recommendations.

One of the objectives of the project is to see if every-other-day delivery can be justified from the standpoint of maintaining a good quality of milk.

What Is Oxidized Flavor in Milk?

Neither the layman nor the scientist can answer that question fully, yet both know when it is present and prefer that it be absent. This problem has been studied for about 12 years.

"Oxidized flavor" in milk is quite seasonal. It is at its worst during the winter months, with the cows on dry feed, and it practically does not exist in summer, when the cows are on pasture. Then, too, cows differ a good bit in their tendency to produce milk with this off-flavor. By now, dairymen have learned how to reduce or avoid the flavor, and chemists are learning slowly how to remove the substances responsible for it. Contaminating the milk with small bits of iron or copper makes the flavor worse. Hence the workers in many dairies handle the milk in such a way as to avoid contact with copper, brass, and iron. Instead, they use aluminum, tin, or stainless steel equipment.

Chemists, on the contrary, purposely *add* copper, at the rate of two or three parts per million parts of milk, in order to develop the flavor before isolating the off-flavor substances that are formed. In West Virginia, R. B. Dustman and C. A. Flanders have found that the flavor-causing materials can be removed by distilling the milk with steam under reduced pressure. During the winter of 1945-46 they distilled 550 gallons of milk in batches of 1½ to 2 gallons each. When the different parts that make up milk were extracted, worked down, and collected, there was left less than a teaspoonful of a light amber-colored liquid. This had a strong odor.

The question now is, What are the substances present in this bit of liquid? Before that one can be answered, another one must be solved—how to get more teaspoonfuls to work with. When we have enough of that liquid, we can examine it chemically and thoroughly.

DDT Really Keeps the Flies Down

Every dairyman faces the nuisance of flies in dairy barns and on the cattle during the summer. We felt that perhaps some solution to the fly problem could be found. In May 1945 the Dairy Department entered into an experiment with the Entomology Department to determine how effective DDT might be in controlling flies. It was our firm belief that DDT, used in a water suspension applied directly to cattle in amounts needed to control the flies, would not be harmful.

Acting upon the entomologist's advice, George Hyatt, Jr., sprayed all the dairy cattle about the middle of May. He did the same with the dairy barns, the manure pit, the bull barn, and the calf barn. Considerable care was taken to saturate those places where flies are thicker such as the manure track, ventilator openings, etc. When applied directly to the cattle, 16 pounds was used of 50 percent DDT material, dissolved in 100 gallons of water. When applied to the walls of the barn, 24 pounds of the same strength was used in 100 gallons of water. We made no attempt to

cover drinking cups or feed troughs. The cattle were soaked except for heads and udders, using a pressure pump. (To be effective, plenty of pressure is important because the material must go on the *skin* and not just the hair coat.) The cows were kept in the barn for half an hour after spraying, so that they would be thoroughly dry before going out to pasture.

And what happened? Flies in the dairy barn and on the cows were almost completely controlled until the last week of July, when the same treatment was repeated. The heifers that were on pasture the entire summer were almost entirely free from flies from May till late July. After the second spraying, flies didn't bother for the rest of the season.

As a result of our 1945 experience, we decided in May 1946 to try to make one spraying last through the season. This time we used a somewhat stronger solution than before. Forty-eight pounds of the 50 percent DDT in 100 gallons of water was used this time when applied directly to the barn, and 32 pounds when applied to the cattle. This was just double the 1945 rate. The same method of application was used. No precautions were taken to cover feed troughs or drinking cups.

The milking cows and the heifers, as well as the barns, were almost entirely free from flies until about August 5, when some build-up of flies began. It was necessary to spray the barns and the cattle again on August 26. The number of flies were building up rapidly at that time, particularly on the heifers that had been on pasture all summer.

We feel that a slightly heavier application than was used in May 1946 would give fly control for the entire season. There have been absolutely no harmful effects to any of the animals, even in the calf barn, where the material ran down the sides of the wooden pens and dropped off the ceilings into the pens. We are continuing the experiment in 1947 to see if one spraying will control flies for the entire season.

More on Insect Control

DDT is good not only in orchard pest control. It does extremely well in dairy circles, too. We have been able practically to rid dairy herds of hornfly in places not too close to untreated premises. The hornflies must have a blood meal before laying their eggs. When they rest on dusted or treated animals, they die before they can lay the eggs.

Some species of the horsefly family are controlled by DDT, but not as fast as the other species of flies. Some 3 days after treatment of stock, the horseflies kept away altogether for several weeks.

Other routine work under this project has to do with keeping records of climate, temperature, rainfall, air pressure, and other factors. All these deal with the life processes of insects. The more we learn about them, the better we know where to strike in insect control.

FORESTRY

Your Timber—Is It Turning a Profit?

For better than 10 years we have been n search of ways to help farmers man- ıge their timberland. There are acres ınd acres of woods on many farms of he state. After all, these can be an asset, ınd the farmer may as well realize a ›rofit from them. But it takes skill in nanagement, and that's where we can ıelp. Under the leadership of W. C. Percival, the West Virginia Forest Products Association was organized in 1937. Since then some 40,000 acres in 16 counties have been entered in a cooperative arrangement between the landowners and county units of the association.

Those farmers can get expert management on timberland which they themselves cannot take care of. They

Height, diameter, and rate of growth are measured on sample trees on Cooper's Rock Experimental Forest in Preston County. Here a student and a professor measure the height of an oak with tape and abney level.

may have stands of white oak that will make good barrel staves. Or they may have small timber suited to making mine props.

Percival and Torkel Holsoe have been looking into the costs of technical mar agement. In the near future we plan t publish a bulletin giving the results c their study.

Management May Vary With Forest Type

Part of our job is to practice what we preach. In an experimental area of 8,000 acres of cut-over, burned-over land, in Cooper's Rock State Forest, Lowell Besley and E. H. Tryon are testing several types of timber management. This area lies in Preston and Monongalia Counties; any results here can be applied to similar types of timberland i other parts of the state.

Studies so far reveal that a desirabl mixture of tree species is coming i naturally on old burns. Excellent growt is getting established. These stanc should respond well to sound manage ment; and show a profit, too.

Could Use a Handier Sawmill

One of these days there is going to be a circular sawmill that will fit the farm. No, not the portable kind. What we need on our farms (and what good West Virginia farm doesn't keep a sizable woodlot?) is an outfit on wheels. One that can be hauled by truck to a convenient point, go through its paces, and move on again to another farm.

Now, there is such a machine in Wisconsin. They call it a timber harvester and from all reports, it really is paying its keep. But those boys live in fairly flat country and they can use an acre to turn around. We need a sawmill that can make short turns on our roads and forest trails. Their long machines are no go in the mountains.

But the principle is all right. All i needs is to adapt it to our condition Our foresters, with Jack Byers in charge are now designing a sawmill with a ver short wheelbase. The machine of cours must have a minimum length to do it work. That means that part of it has t hang over the truck tractor so as t swing around the short turns.

Such a mobile circular sawmill ca make money for farmers owning heav timber and wanting to cut a barn pat tern or to market the big logs. With competent sawyer who knows his equip ment, this outfit can be on the job al year, moving from farm to farm as de mand warrants. The scheme fits well in to a program of woodlot management.

Timber Volume Estimated From the Air

This business of photographing forest tracts from the air has been developed to a practical point. Where there are only one or two species of evergreens on level ground, these pictures are a great help in the cruising of timberland. But with the mixed species o Appalachian hardwoods that you find i the hills, it's a different story. That' where we would like to use air pictures and that's the problem that Torkel Hol soe, Wilbur Nelson, and W. C. Perciva

have been working on.

Photographs have been taken with a special type of film which gives us excellent chances of recognizing different broadleaf species. When color filters are used with this film, we can tell the difference between the several shades of green which occur in tree foliage.

Our Forest Lands Need Tax Equality

West Virginia as a state will get nowhere along the taxation road as long as there are great inequalities between assessments and property valuations, and great inequalities among the counties and even among assessment districts of the same county.

L. Besley and J. B. Byers have collected information on assessments as well as farm and forest appraisals in five representative counties. There they found how much variation there is between "true-and-actual" value and assessed valuation. In one county the land was assessed at only one-fifth its actual value, in another county one-half, and in still another county the woodland was given an assessed valuation *one-fifth greater than* its appraised value. In most counties there was little difference between woodland and all lands. That is to say, if all lands were assessed at one-half their value, the woodland fraction of that land averaged much the same in proportion.

(P.S. Until the public is aroused to the importance of electing assessors who will fearlessly assess all property in an equitable way, we shall continue to suffer these inequities. Too often there are losses in revenue, and this is becoming more and more important in the economy of the counties.)

West Virginia's First Wildlife Cooperative

One thousand acres covers a lot of territory. But that is what it takes for a census of farm game and wildlife.

In Upshur County the Forestry Division is cooperating with farmers in an area of that size. It is the first such cooperative in West Virginia. The cooperators carry on approved wildlife practices under the direction of Maurice Brooks and R. F. Dugan.

They count cotton-tail rabbits by trapping methods. A check census is being made on a nearby area which has no game-management program. On the 1,000-acre area they trap foxes intensively to learn their food habits and to determine their influence on game population. The censusing of rabbits and the kill records of other game species are being continued on about 50 cooperating farms in Upshur and Barbour Counties.

SPECIAL TOPICS

Vitamins Are Key to Many Secrets

Animals need a special vitamin if they are to reproduce normally. Sterility results when the amount of vitamin E in the food eaten is low. This vitamin is, of course, not the only vitamin influencing reproduction. How the other dozen or so vitamins influence animal reproduction is not well understood.

V. G. Lilly and H. L. Barnett are finding that several of the vitamins that are soluble in water control sexual reproduction in some of the fungi. These low forms of plant life are easily studied; they have the advantage that the life cycle is short. Whether these studies will aid the understanding of some of the problems of animal reproduction we do not know. These investigators work on the belief that living things, whether plants or animals, are basically alike in many ways. Knowledge gained in one field of research can often be used in another. We know that from experience.

Low Forms of Life Aid Vitamins

Vitamins are complex chemical substances found in nature that are needed desperately for normal animal growth, but only in very small amounts. Vitamins are produced in nature chiefly by growing plants. We get most of our vitamins by eating plants, or by eating plant-eating animals that have gathered a supply of vitamins in their body tissues. Almost everybody knows that *man* and *animals* need vitamins for normal, healthy growth. It may surprise some to learn that many *plants,* especially bacteria and fungi, must have vitamins for their proper growth and development.

Some of the vitamins needed by fungi and bacteria are the same as those required by animals, and some are different. The knowledge we have on feeding with vitamins is applied in much the same way to both plants and animals. Whatever we learn about the role of vitamins in the growth and reproduction in *fungi* will help us understand their role in feeding *human beings.*

Since fungi and bacteria grow so fast and are so much easier to grow in quantity, they are especially suited to studying the principles that underlie vitamin action. This is one of the first aims of a project on the physiology of fungi, directed by H. L. Barnett and V. G. Lilly. The results they are getting will benefit the study of vitamins in humans. The study will also help our understanding of how those fungi and bacteria behave that cause plant diseases.

There's Money in Farm Sidelines

Much interest has developed in West Virginia in the production of holly suitable for sale in the Christmas trade.

E. H. Tryon built a coldframe with bottom heat, for the purpose of rooting holly cuttings. These cuttings he got

This rooted holly cutting was treated with indolebutyric acid and placed in a cold-frame. Shown after 41 days in the frame.

from selected native stock in August 1946, placed immediately in the cold-frame, and left at a temperature of 70° F. While the roots of all cuttings have not been examined, according to surface appearance the roots have developed successfully. This encourages us to believe that a low-cost method of propagating holly may be found some day.

A 10-acre area has been set aside on the Arthurdale Farm in Preston County for the purpose of producing a black-walnut seed block. Four different varieties will be grown. From these we should get a source of superior black walnut seed for planting in West Virginia.

Let the Fish Bite!

You hear a good bit now and then about the advantages of having a fish pond on the place. R. F. Dugan has begun some management studies on seven farm fish ponds in Upshur and Barbour Counties. Only one of these has been stocked long enough to yield records of fish harvest. It covers 2.2 acres—a fair size for any farm.

Well, the first full year of fishing yielded 84 bass weighing 44 pounds, plus 882 blue gills weighing 209 pounds. The pond took 7 applications, 220 pounds each, of 8-8-4 fertilizer.

This project will show up fish-production figures which should give us a fair idea of what can be expected from a well-managed pond. It looks to me like there's money in it. And a lot of pleasure, too.

Nutmeats Can Be Disinfected

This Experiment Station a few years ago began what we call a hillculture project. Our aim there is to find ways to make use of anything on the farms of the state that will add to the farmer's income. This includes such items as maple syrup, holly, blueberries, and nut meats.

A good bit of money has been made out of the sale of black walnut meats, and our hillculture project has helped it along. But there are problems attaching to the marketing of these nuts, and marketers must observe the Federal pure foods laws that deal with the interstate shipment of shelled nuts. These laws require first of all that nut meats must not be carriers of disease-producing bacteria of intestinal origin.

H. D. Erickson and A. R. Colmer have been studying how to destroy these

germs by pasteurizing the meats. They used a kiln in which they could control temperature, humidity, air circulation, and the length of time of pasteurizing. With this equipment they have been able to kill intestinal bacteria of an unsanitary sort in the meats, without hurting their salable qualities. At the same time they have developed a method for determining the number of bacteria in solid material such as foods.

Population Changes and Employment

Ordinarily there are more workers in this state than can find gainful employment. That means a surplus labor force, and that brings with it problems of a sort.

Reed Bradford undertook to study this problem and he sees some trends that have important meanings for the future. For one thing, the rate of population growth in West Virginia has been less in each census since 1900. He reports the highest reproduction rate in the southern coal fields and in some farming sections in the central portion. The rural farm population has the highest fertility, the rural population other than farm has the second highest, and the city population has the lowest reproduction rate. It may be worth noting that the white population showed higher rates than the Negro population.

CHANGES IN STAFF

New appointments within our research staff during the two-year period 1944-1946 include J. H. Clarke, assistant agricultural economist; A. R. Colmer, associate bacteriologist; C. A. Flanders, assistant biochemist; George Hyatt, Jr., associate dairy husbandman; Gertrude McAllister, assistant in home economics; M. A. McHale, assistant animal pathologist; B. J. Patton, soil scientist; O. E. Schubert, assistant in horticulture; R. M. Smith, soil scientist; E. H. Tryon, assistant silviculturist; W. J. Tyler, assistant in dairy husbandry; J. R. Vaughn, assistant plant pathologist; Collins Veatch, associate geneticist; S. J. Weese, assistant dairy husbandman.

Promotions include R. A. Ackerman, assistant dairy husbandman; Lowell Besley, forester; R. H. Black, assistant animal husbandman; F. D. Cornell, Jr., assistant director; Edwin Gould, entomologist; B. H. Schneider, animal husbandman; K. C. Westover, horticulturist; C. V. Wilson, animal husbandman.

During the same period the following have resigned: M. A. Abrahamsen, associate agricultural economist; F. W. Besley, associate forester; G. A. Bowling, associate dairy husbandman; R. H. Bradford, associate rural sociologist; W. M. Broadfoot, assistant in agronomy; Helen G. Charley, assistant home economist; V. B. Fish, assistant agricultural chemist; C. V. Lowther, assistant in plant pathology; D. N. Putnam, assistant in dairy husbandry; T. D. Runnels, assistant in

poultry husbandry; W. B. Sayers, assistant forester; C. E. Stockdale, associate agricultural economist; Myrtle Swanson, assistant in home economics.

In the death in 1945 of Leon H. Leonian, mycologist, the Experiment Station has suffered the loss of a keen scholar and a discerning scientist.

PUBLICATIONS OF THE BIENNIUM 1944-1946

BULLETINS AND CIRCULARS

Bul. 314. R. O. Weibel. Winter barley in West Virginia. July 1944.
Bul. 315. R. H. Sudds. Tests of four nitrogen carriers in a mature apple orchard at Martinsburg, West Virginia. July 1944.
Bul. 316. M. G. Brooks. A check-list of West Virginia birds. December 1944.
Bul. 317. C. R. Orton. Farm science looks ahead. Biennial report of the director for the period 1942-1944. December 1944.
Bul. 318. Hazel C. Cameron. A nutrition study of West Virginia students. March 1945.
Bul. 319. L. H. Leonian and V. G. Lilly. The comparative value of different test organisms in the microbiological assay of B vitamins. June 1945.
Bul. 320. D. M. Keyes. More production through better practices. September 1945.
Bul. 321. R. M. Smith, G. G. Pohlman, and D. R. Browning. Some soil properties which influence the use of land in West Virginia. September 1945.
Bul. 322. D. S. Brown. Growth and composition of tops of peach trees in sand culture in relation to nutrient-element balance. September 1945.
Bul. 323. M. A. Abrahamsen. Egg and poultry marketing practices in West Virginia. September 1945.
Bul. 324. F. W. Schaller, G. G. Pohlman, H. O. Henderson, and R. A. Ackerman. Pasture fertilization experiments at Reymann Memorial Farm. November 1945.
Bul. 325. T. B. Clark and C. J. Cunningham. Soybean oil meal in poultry rations. November 1945.
U.S.D.A. Tech. Bul. 889. W. H. Black and C. V. Wilson. Fattening yearling cattle in the Appalachian region. April 1945.
Cir. 80. J. H. Rietz and C. V. Wilson. Early and late treatment of market lambs for gastrointestinal parasites. May 1945.
Sp.Cir. 1. W. W. Armentrout. Farmer's stake in price control. January 1946.
Sp.Cir. 2. (Post-war Planning Committee.) Charting a route for agriculture in West Virginia. June 1946.

MIMEOGRAPHED CIRCULARS

No. 50. R. M. Smith and G. G. Pohlman. Reseeding West Virginia pastures. February 1945.
No. 51. G. G. Pohlman. Meadow and pasture mixtures for West Virginia. February 1945.
No. 52. J. L. Cartledge, R. J. Friant, R. M. Smith, and D. R. Browning. Results of hybrid corn yield trials in West Virginia for 1944. February 1945.
No. 53. R. M. Smith and E. H. Tyner. Reclaiming strip-mine spoil areas. March 1945.
No. 54. R. M. Smith and S. L. Galpin. The utilization of wet lands in West Virginia. May 1945.
No. 55. C. R. Orton and S. L. Galpin. Approved drainage, grading and plantings for strip-mined lands. December 1945.
No. 56. J. L. Cartledge, R. J. Friant, C. C. Lima, R. M. Smith, and D. R. Browning. Results of hybrid corn-yield trials in West Virginia for 1945. February 1946.
No. 57. T. B. Clark. The protein level in growing and laying rations for chickens. June 1946.

WAR SERIES CIRCULAR

Circ. WS 21. G. G. Pohlman and C. R. Orton. Lime for health. August 1944.

SCIENTIFIC PAPERS

No. 322. E. N. Moore and E. A. Marten. The role of microorganisms in reproductive disorders of the chicken. Amer. Jour. Vet. Res. 5, no. 16: 256-261. July 1944.

No. 323. V. B. Fish, R. B. Dustman, and R. S. Marsh. The ascorbic-acid content of several varieties of apples grown in West Virginia. Proc. Amer. Soc. Hort. Sci. 44: 196-200. 1944.

No. 324. E. T. Wightman, T. D. Runnels, and A. H. VanLandingham. Soybean oilmeal in laying rations. Poult. Sci. 23, no. 5: 394-395. September 1944.

No. 325. R. H. Sudds. Growth and fruitfulness of two apple varieties on French Crab seedlings and on a clonal rootstock. Proc. Amer. Soc. Hort. Sci. 44: 247-250. 1944.

No. 326. V. G. Lilly and L. H. Leonian. The anti-biotin effect of desthiobiotin. Science 99, no. 2567: 205-206. March 10, 1944.

No. 327. D. N. Putnam, G. A. Bowling, and C. T. Conklin. The recognition of the influence of age on butterfat percentage when calculating mature equivalents. Jour. Dairy Sci. 27, no. 11: 903-907. November 1944.

No. 328. T. B. Clark, C. E. Weakley, Jr., and A. H. VanLandingham. Defluorinated superphosphates as phosphorus supplements for chicks. Jour. Assoc. Off. Agr. Chem. 28, no. 1: 118-129. February 1945.

No. 329. L. H. Leonian and V. G. Lilly. A quantitative comparison of biotin and desthiobiotin for the growth of certain microorganisms. W. Va. Acad. of Sci. 17: 55-61 (1944). *In* W. Va. Univ. Bul. 45, no. 10-1. April 1945.

No. 330. T. B. Clark, B. H. Schneider, and A. H. VanLandingham. Protein utilization and supplementary relationships of protein in protein concentrates in basal diets of cereal grains and cereal by-products for growing chickens. Poult. Sci. 24, no. 2: 105-111. March 1945.

No. 331. T. B. Clark, T. D. Runnels, and E. A. Livesay. Crossbreeding in turkeys: I. Effect on fertility, hatchability, and viability of poults. U. S. Egg and Poultry 50: 418-420, 430-431. 1944.

No. 332. E. A. Livesay and U. G. Bee. A study of the gestation periods of five breeds of cattle. Jour. Animal Sci. 4, no. 1: 13-14. February 1945.

No. 333. R. B. Dustman and V. B. Fish. Sugars in apple and cherry blossoms. Plant Physiology 19, no. 4: 603-614. 1944.

No. 334. L. H. Leonian and V. G. Lilly. Conversion of desthiobiotin into biotin or biotin-like substances by some microorganisms. Jour. Bact. 49, no. 3: 291-297. March 1945.

No. 335. R. M. Smith, G. G. Pohlman, F. W. Schaller, and D. R. Browning. Some experiences in revegetating poor hill land pastures in West Virginia for improved conservation and production. Proc. Soil Sci. Soc. of Amer. 9: 200-207. 1944.

No. 336. V. B. Fish and R. B. Dustman. The activity of pactinase (pectinol A*) and some of its possible applications. Jour. Amer. Chem. Soc. 67: 1155-1157. 1945.

No. 337. W. H. Black and C. V. Wilson. Fattening yearling cattle in the Appalachian Region. U. S. D. A. Technical Bulletin 889: 11 pps. April 1945.

No. 338. R. B. Dustman. Sugar distribution in the blossoms and fruit of three varieties of apple. Proc. W. Va. Acad. of Sci. 17: 42-46. *In* W. Va. Univ. Bul. ser. 45, no. 10-1 April 1945.

No. 339. V. G. Lilly and L. H. Leonian. The interrelationship of iron and certain accessory factors in the growth of *Rhizobium trifolii* 205. Jour. of Bact. vol. 50, no. 4: 383-395. October 1945.

No. 340. J. G. Leach, C. V. Lowther, and Mary A. Ryan. Stripe smut (*Ustilago striaeformis*) in relation to bluegrass improvement. Phytopath. vol. 36, no. 1: 57-72. January 1946.

No. 341. R. H. Sudds. The effect of Malling X, XX, and XIII rootstocks on several apple varieties. Proc. Amer. Soc. Hort. Sci. vol. 46: 227-229. 1945.

RESEARCH PROJECTS OF THE BIENNIUM

AGRONOMY AND GENETICS

Variety testing (S 6)
Soil survey work in W. Va. (S 8; coop. USDA)
Alfalfa investigations (S 10)
Crop-rotation experiments (S 11)
Sweet-clover investigations (S 13)
Crop response to various fertilizers (S 14; coop. Horticulture)
Changes in soil condition following mine sealing, tile draining, & surface treatment (S 40)
Corn genetics and breeding (B J 3)
Soil slips in W. Va. (B J 15; coop. State Road Commission)
Reclaiming eroded soils (B J 17; coop. Forestry)
Effect of fertilizer treatment and cropping systems on yield and quality of tobacco (B J 19)
Breeding & improvement of pasture grasses & legumes (B J 26; coop. USDA)
Improvement of supply and utility of water on farms (B J 34)
Revegetation of strip-mined land in W. Va. (B J 39; coop. Forestry & USDA)
Forest-soils studies (B J 9)
Nutritive values of different strains of Kentucky bluegrass & white clover (B J 37; coop. Animal Husbandry)
Plant nutrient availability (P 29)
W. Va. pastures (P 30)
Fusarium wilt of watermelon (P 31; coop. Plant Pathology)
Properties of selected soil profiles (P 35; coop. USDA)
Reclamation of strip-mined land in W. Va. (P 42)
Pasture renovation (P 43; coop. USDA)
Foliar nitrogen, phosphorus, & potassium interactions as influenced by fertilization & soil-nutrient supplies (P 45)
Soil acidity & plant growth (P 2)

ANIMAL HUSBANDRY

Selection in cross-breeding on broilers within certain heavy breeds of chickens (A 7)
Improving market qualities of turkeys by cross-breeding (B J 5)
Selection of breeders in relation to longevity of progeny in S. C. White Leghorns (B J 13)
Immature grass & legume silage for chickens (B J 36; coop. Biochemistry)
Effect of hay-storage methods on nutritive value for sheep & beef cattle (B J 24; coop. Biochemistry)
Relationships of the avian-leukosis complex to reproduction disorders (B J 28)
Values for growth of proteins of feeds used in poultry rations (P 4; coop. Biochemistry)
Silages for cattle & sheep (P 34; coop. Biochemistry)
Preparation of monograph on digestibility of feeds (P 36)
Methods of feeding chicks & pullets (P 39)
Comparison of native & Western ewes for production and longevity (P 41)
Breed as factor in sheep production & quality of products (P 5; coop. USDA)
Feeding & fattening of steers & heifers (P 7)
Phenothiazine and salt mixture as an anthelmintic for gastro-intestinal parasites of ewes & lambs (P 38)
Effect of rations & methods of feeding grain on egg production (S 15)
Battery rations for growing chicks (S 17)
Comparison of dried-milk products with dried molasses and yeast concentrate as riboflavin carriers in starting & growing rations for chickens (P 39)
Soybean oil meal in poultry rations (S 44)

BIOCHEMISTRY (AGRICULTURAL)

Pigmentation and ripening of fruits (A 3)
Isolation, purification, & determination of hemicellulose in feed and food (A 12)
Feeding of thyroprotein to dairy cattle (B J 38; coop. Dairy Husbandry)
Miscellaneous investigations (S 5)

ECONOMICS (AGRICULTURAL)

Transportation & marketing problems arising out of war (B J 30)
War-production goals & their attainments in W. Va. (B J 31; coop. USDA)
Broiler industry in Northeastern W. Va. (B J 40)
Factors involved in profitable orcharding in the Eastern Panhandle (P 27)
Farm-labor situation in W. Va. (P 37)
Agricultural lime supply in W. Va. (P 44)

DAIRY HUSBANDRY

Transmission of milk & butterfat production & body conformation of dairy sires (P 14)
Oxidized flavors in milk (P 23; coop. Biochemistry)
Alfalfa & timothy hay with and without corn silage for dairy cattle (P 25; coop. Biochemistry)
Growth study of Ayrshire cattle (S 21)

Varieties of pasture for milk production (S 22; coop. Agronomy)
Analysis of breed-association records as basis for breed-improvement program (S 38; coop. Ayrshire Breeders Assn.)
Construction of tipple for loading manure into trucks and spreaders (S 48; coop. Agr. Engineering)

ENGINEERING (AGRICULTURAL)

Design & construction of machine for treating wheat & barley seed with hot water for control of loose smuts (S 45; P 40; coop. Plant Pathology)
Design & construction of hay hoists (S 47)

ENTOMOLOGY

Relation of temperature & other physical factors to insects (A 1)
Biological & mechanical control of codling moth (B J 1; coop. USDA)
Biology & control of insects of major importance in commercial orchards (P 9)
Miscellaneous insect and insecticide studies (S 24)

FORESTRY

Effect of black-walnut trees & their products on vegetation (B J 22)
Growth conditions as related to physical properties of Appalachian hardwoods (B J 35)
Conservation of farm woodlands in W. Va. through sustained-yield management & marketing practices (B J 7; coop. Conservation Commission)
Forest taxation in W. Va. (B J 29; coop. Conservation Commission)
Management of farm fish ponds in W. Va. (B J 41; coop. Conservation Commission, Soil Conservation Service, U. S. Fish & Wildlife Service)
Profitable tree forms (S 37)
Forest plantations in W. Va. (S 41; coop. Agr. Extension Division)
Improvement of farm game and wildlife conditions on a soil-conservation district (S 42; coop. Agr. Extension Division, Conservation Commission, Soil Conservation Service, Farm Security Administration)
Pulpwood debarking machine for W. Va. hardwoods (S 46; coop. Agr. Engineering, Eng'g. Experiment Station, W. Va. Forest Products Assn., W. Va. Pulp & Paper Co.)
Production, development, and marketing of hillculture products in W. Va. (S 49; coop. Soil Conservation Service)

HORTICULTURE

Improvement of potato varieties for W. Va (A 11; coop. Plant Pathology an USDA)
Selection, breeding, & propagation of low bush blueberry, *Vaccinium vacillans* (J 12)
Effect of cultural practices & orchard-soi management on soil moisture & avail ability of plant nutrients to fruit tree (B J 16)
Nutrient studies with peaches with particula reference to potassium (B J 23)
Green-manure rotations for soil fertility i vegetable-crop production (P 11)
Improvement of fruit-tree root stocks (P 16 coop. USDA)
Climate & soil factors affecting fruit produc tion in W. Va. (P 17)
Miscellaneous horticultural investigation (S 27)
Cultural treatments and fertilizers for fruit (S 28)
Variety tests of tree and small fruits (S 29)
Training and pruning fruit trees (S 30)
Variety and strain studies of vegetable (S 31)
Productivity of carnation as affected by ag of cutting & time of planting (S 34)
Fertilizer and cover-crop studies with aspara gus (S 36)

PLANT PATHOLOGY

Effect of environment upon morphology parasitism in fungi & bacteria (A 6)
Anatomical & histological changes in disease plants (A 10)
Nature & effect of substances which induc or stimulate growth & sexuality in fun (B J 2; coop. U. S. Army, Chemic Corps)
Apple-fruit & leaf injury caused by sprayin & unfavorable weather (B J 6; coo Agronomy, Entomology, Horticultur Virginia, Maryland, Pennsylvani USDA)
Potato-wilt disease of unknown natu (B J 8)
Testing substitute fungicides (B J 32; coo Entomology, Horticulture; other state chemical companies)
Nutritional value of apples (B J 33)
Apple measles (P 19)
Black root-rot of apples (P 21; coop. W. V fruit growers)
Forest-tree diseases (S 18)
Miscellaneous plant-disease investigatio (S 19)

THE AGRICULTURAL EXPERIMENT STATION STAFF

(As of July 1, 1947)

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[4]In cooperation with the U. S. Department of Agriculture.

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ΠΑΣΕΙ ΤΗΝ ΑΡΕΤΗΝ ΕΝ ΔΕ ΤΗ ΑΡΕΤΗ ΤΗΝ ΤΟΣΙΝ